(12) PATENT APPLICATION (11) Application No. **AU 198826786 A1**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
Shockproof composite glazing

(51) International Patent Classification(s)
B32B 017/10 **C03C 017/42**

(21) Application No: **198826786** (22) Date of Filing: **1988.12.12**

(43) Publication Journal Date: **1990.06.14**

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1830-03-00

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Patents Act

DECLARATION FOR A PATENT APPLICATION

▼ INSTRUCTIONS
(a) Insert "Convention" if applicable
(b) Insert FULL name(s) of applicant(s)

In support of the (a) application made by
(b) Morton Thiokol, Inc.
110 North Wacker Drive
Chicago, Illinois 60606-1560 U.S.A.

(c) Insert "of addition" if applicable
(d) Insert TITLE of invention

(hereinafter called "applicant(s)") for a patent (c) for an invention entitled (d)
COMPOSITE GLAZING PRESENTING PROPERTIES OF SHOCK RESISTANCE

(e) Insert FULL name(s) AND address(es) of declarant(s) (See headnote*)

I ~~am~~ (e) Gerald K. White, Assistant Secretary of Morton Thiokol, Inc., of 110 North Wacker Drive, Chicago, Illinois 60606-1560 U.S.A.

do solemnly and sincerely declare as follows:

~~[illegible]~~

1. I am/~~We are~~ authorized to make this declaration on behalf of the applicant(s).

~~[illegible]~~.
(or, *where the applicant(s) is/are not the actual inventor(s)*)

(f) Insert FULL name(s) AND address(es) of actual inventor(s)

2. (f)
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~~is~~/are the actual inventor(s) of the invention and the facts upon which the applicant(s) is/~~are~~ entitled to make the application are as follows:

(g) Recite how applicant(s) derive(s) title from actual inventor(s) (See headnote**)

(g)
Applicant is the Assignee of the invention from the actual inventors

(Note: *Paragraphs 3 and 4 apply* only *to Convention applications)*

(h) Insert country, filing date, and basic applicant(s) for the/or EACH basic application

3. ~~The basic application(s) for patent or similar protection on which the application is based~~ is/are identified by **country, filing date, and basic applicant(s)** as follows:

(h)

4. The basic ~~application~~(s) referred to in paragraph 3 hereof was/were the first application(s) ~~made in a Convention country in respect of the invention the subject of the application.~~

(k) Insert PLACE of signing

(l) Insert DATE of signing

(m) Signature(s) of declarant(s)

Note: No legalization or other witness required

Declared at (k) Chicago, Illinois U.S.A.
Dated (l) this 10th day of January, 1989.
(m) Gerald K. White
Gerald K. White
Assistant Secretary

To: The Commissioner of Patents

P18/1/78

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Patent and Trade Mark Attorneys
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c) preparing a sheet of a resin of which one face is treated by an anti-abrasion product, constituted by the deposit of a film of hardening resin such as melamine;

d) depositing the non-treated face of the sheet of synthetic resin (the treated face therefore facing the outside) on the free face of the film of the interstitial binding agent itself resting on the sheet of glass;

e) placing the whole of the complex thus produced in a bag of supple, tight material, formed for example by a plastic film;

f) creating a vacuum in the bag and closing the opening for example by welding;

g) placing the assembly in an autoclave in order to undergo therein a cycle of heating under pressure;

h) then withdrawing from the bag the glazing thus produced, of which the edges are subjected to burring.

French windows, etc.. of a building or premises which may or may not be inhabited.

It is therefore a first object of the present invention to provide composite glazing presenting considerably improved properties over glazing used traditionally, but without presenting the drawbacks thereof, particularly the weight and thickness which, up to the present time, limited the interest of the composite glass structures offering mechanical properties of shock resistance.

Another object of the invention is to provide, under economical conditions, composite glass structures adapted to be used in particular for automobile vehicles, without representing a source of excess weight nor requiring a modification of the structures, frame, doors, etc... receiving such glazed surfaces.

It is another object of the invention to allow use of glass structures presenting improved properties not only of resistance but also of heat transmission.

Various formulae of glazing of the "composite" type are known, which enable the glazed surfaces to withstand attempted breaking and entering.

Tempered plate glass for example is known, which undergoes a heat treatment which improves the qualities of the glass composition with respect to the conventional annealed glass; however, tempered plate glass offers only an extremely low mechanical resistance since it breaks under the first shock of a hammer with a force of the order of 100 to 110 joules.

For this reason, tempered plate glass is not used for glazed surfaces presenting useful properties of shock resistance; it is essentially used for its properties of withstanding an attempted cutting (for example by means of a diamond), since it shatters

PATENT OFFICE 77 Sec AUSTRALIAN

resin, the two sheets being joined by an interstitial binding agent, the glazing presenting properties of shock resistance constituting a dissuasive element in the event of breaking and entering, the glazing being characterized in that the sheet of organic resin is selected from those with high mechanical resistance, including polycarbonates, polyarilates, acrylic resins, and the binding agent is selected from those presenting a very high adherence, and in particular among the aliphatic polyurethanes and ethylene vinyl acetate (EVA).

The invention relates more especially to transparent glazing adapted to constitute a window for equipping vehicles, particularly automobile vehicles, and it is characterized in that the thickness of the sheet of inorganic glass is included between 2.5 and 4 mm, the thickness of the sheet of organic resin is included between 1 and 2 mm, the thickness of the film of interstitial binding agent is included between 0.25 and 0.75 mm, allowing it to be positioned in the existing rabbets and slideways of automobile vehicles, the novel glazing thus avoiding excess weight for the vehicle with respect to the standard inorganic glass glazing.

According to a more particular feature, the sheet of organic resin is made of polycarbonate and the interstitial binding agent is an aliphatic polyurethane.

More especially, the sheet of polycarbonate comprises on its outer face (opposite the face adhering on the sheet of glass) an anti-abrasion coating.

In particular, the anti-abrasion coating is based on melamine.

According to another feature, the invention relates to a glazing for automobile equipment, a compo-

AUSTRALIAN PATENT OFFICE SEC 77

minutes until a temperature of between 120 and 160°C is attained, said temperature is then maintained level for a duration of 10 to 20 minutes under a pressure of between 10 and 15 bars; after which a third phase of temperature reduction lasts from 10 to 20 minutes until atmospheric pressure and ambient temperature are resumed.

According to a more precise embodiment, the duration of the cycle is 1 hour, composed of a phase of 20 minutes corresponding to the rise of temperature and pressure up to a temperature level equal to 140°C and to a pressure of 13 bars, said temperature remaining level for 20 minutes, after which the cycle terminates by a final phase of 20 minutes corresponding to the return to atmospheric pressure and to ambient temperature.

A sheet of resin is preferably used, which is constituted by a polycarbonate associated with an interstitial binding agent constituted by an aliphatic polyurethane.

According to a variant embodiment, the invention also relates to glazing equipping an automobile vehicle to be used as windscreen and in which are associated a first sheet of glass with a thickness of 2 to 3 millimeters and preferably 2.2 millimeters thick, an interstitial film of aliphatic polyurethane with a thickness of 0.3 millimeter, an intermediate sheet of polycarbonate with a thickness of between 0.5 and 1 millimeter, and preferably 0.8 millimeter, a second interstitial film of aliphatic polyurethane, with a thickness of 0.3 millimeter and finally a second sheet of inorganic glass with a thickness of between 2 and 3 millimeters and preferably a thickness of 2.8 millimeters, the assembly of the composite glazing having a maximum total thickness of 6.4 milli-

AUSTRALIAN Sec 77 PATENT OFFICE

resistance also being valid when its thickness is close to those of the conventional glazings, this avoiding any modification of the rabbets normally used.

The high-resistance synthetic sheet may be adhered on tempered plate glass, on annealed glass or on laminated glass.

In the case of adhesion of such a sheet on tempered plate glass or on annealed glass, said sheet is always disposed inside the vehicle or building.

In the case of adhesion of such a sheet in a laminated glazing, this high-resistance sheet is at the centre, bonded to the two sheets of glass by two films of adhesive. In that case, the problems of resistance to scratches are not raised. All glazing made according to the invention, whether the glass is annealed, tempered or laminated, withstands at least 20 hammer blows of 100-120 joules, before allowing passage of a hand inside the building or vehicle. These 20 blows are effected in 20 or 25 seconds. The dissuasive effect is therefore very considerable, and this for glazing according to the invention whose thickness is close to conventional glazing.

The high-resistance synthetic sheets may be based on methyl methacrylate or acrylic resin, or films based on polyarylate, or films based on polycarbonate of which one face has been subjected to anti-scratch treatment. In order to obtain glazing according to the invention, of thickness close to conventional glazing, the thickness of the film of polycarbonate is included between 0.3 and 1 mm, that of the other films between 1 and 1.5 mm.

In the case of using glazing according to the invention in buildings, where a high resistance is sought above all, the thickness of the high-

AUSTRALIAN Sec 77 PATENT OFFICE

In the case of the mobile windows of a vehicle, there is no need to modify the slideways.

The process for producing the composite glazing according to the invention, adapted to delay breaking and entering, is carried out differently from the conventional laminated glazing. Pre-adhesion (or bubble-removal), adhesion and shaping of the high-resistance plastic sheet are carried out in one single operation.

In addition, the use of films based on EVA not only further simplifies this process of production, but also considerably reduces the investment necessary in the workshop.

Some embodiments according to the invention will be described hereinafter:

Example 1

A sliding window for a vehicle (Peugeot 305) is to be produced: this front left window is tempered, slightly convex, its thickness is 3 mm. It is treated with a 2% solution A1100 of Union Carbide in water. It is sprayed and dried. Operation is then as follows:

- assembly of the treated window, a straight-chain polyurethane (PU) film 0.38 mm thick manufactured by the firm QUIMAL (this film is in contact with the treated face of the glass, inside the vehicle), a film of polycarbonate (PC) manufactured by GENERAL ELECTRIC PLASTICS, 0.9 mm thick with one face subjected to anti-scratch treatment, on the side opposite the adhesion. This assembly is disposed in a polyamide bag. A vacuum is created. The opening is welded to ensure tightness and to maintain the vacuum. The bag is placed in an autoclave. The duration of the cycle is about 1 hour, namely: 20 minutes for the rise in temperature and pressure, 20 minutes for level temperature at 140°C under a pressure of 13

AUSTRALIAN Sec 77 PATENT OFFICE

dimensions of the glazing: 110 x 50 cm
total thickness: 13 mm

Assembly is effected as hereinbefore: it is disposed in a polyamide bag, a vacuum is created, the opening is welded.

The bag is placed in an oven at 140°C for 45 minutes. The glazing is withdrawn from the bag. It then suffices to burr it lightly on the periphery before disposing it in a suitable rabbet of 25 mm.

This glazing is not cut through, even after 100 hammer blows in the manner described in Example 1.

The adhesive used has a resistance, in traction/shear, of 65 Dan/cm^2 in the glazing thus produced.

It should be especially noted that not only there is no treatment of the glass with a primer, but there is also elimination of the autoclave. A stove suffices to effect adhesion in such an assembly.

Example 3

A windscreen is to be made according to the invention, such as that of the Renault Super 5 car.

The following are assembled:

- glass, 2.8 mm thick (treated on the adhered face with silane),
- aliphatic polyurethane film, made by QUIMAL, 0.3 mm thick,
- polyarylate film, 1 mm thick, made by SOLVAY,
- aliphatic polyurethane film, 0.3 mm thick, made by QUIMAL,
- inner glass, 2.2 mm thick (treated with silane on the adhered face).

The same modus operandi is used as that described in Example 1.

The total thickness of the glazing thus produced is 6.4 mm. An ordinary windscreen has a thickness

AUSTRALIAN Sec 77 PATENT OFFICE

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CLAIMS

4. Glazing according to one of Claims 1, 2 or 3, characterized in that the sheet of polycarbonate comprises on its outer face (opposite the face adhering on the sheet of glass) an anti-abrasion coating.

5. Glazing according to Claim 4, characterized in that the anti-abrasion coating is based on melamine.

6. Glazing according to one of Claims 2, 3, 4 or 5, characterized in that the sheet of inorganic glass presents a thickness of less than 3.5 mm, the sheet of organic resin, such as polycarbonate, presents a thickness less than 2 mm, the binding agent, constituted by an aliphatic polyurethane, presents a maximum thickness of 0.5 millimeter, the complex glazing presenting such a resistance to shocks that they withstand at least 20 consecutive hammer blows with a force of between 100 and 110 joules.

7. Glazing according to one of Claims 1 to 6, characterized in that the glazing comprises a layer of inorganic glass and a layer of synthetic resin, joined by an interstitial binding agent, the join of the two outer layers (synthetic resin and inorganic glass) and the interstitial binding agent being obtained after insertion of the complex glazing in a tight bag sealed in vacuo and the assembly being subjected to a heat treatment under pressure.

8. Glazing according to Claim 1 and adapted to equip an opening, window or French door for a building, characterized in that the sheet of inorganic glass presents a thickness of between 3 and 5 mm, the sheet of synthetic resin presents a thickness

AUSTRALIAN PATENT OFFICE 77 Sec

sheet of glass;
e) placing the whole of the complex thus produced in a bag of supple, tight material, formed for example by a plastic film;
f) creating a vacuum in the bag and closing the opening for example by welding;
g) placing the assembly in an autoclave in order to undergo therein a cycle of heating under pressure;
h) then withdrawing from the bag the glazing thus produced, of which the edges are subjected to burring.

11. Process according to Claim 10, characterized in that the structure, placed in the bag in vacuo and hermetically closed, is subjected to a heat cycle lasting from 40 to 70 minutes and comprising a first phase of temperature rise of 10 to 30 minutes until a temperature of between 120 and 160°C is obtained, said temperature is then maintained level for 10 to 20 minutes under a pressure of between 10 and 15 bars, after which a third phase of temperature drop lasts from 10 to 20 minutes until atmospheric pressure and ambient temperature are resumed.

12. Process according to one of Claims 10 or 11, characterized in that the duration of the cycle is one hour, including a phase of 20 minutes corresponding to a rise in temperature and pressure up to a level temperature of 140°C at a pressure of 13 bars, such level being maintained for 20 minutes, after which the cycle terminates in a final phase of 20 minutes corresponding to the return to atmospheric pressure and to ambient temperature.

13. Process according to one of Claims 10 to 11, wherein a sheet of resin is used, constituted by a polycarbonate associated with an interstitial bin-

AUSTRALIAN S&C 77 PATENT OFFICE

characterized in that it comprises an inorganic glass with a thickness of 4 mm, an EVA film with a thickness of 0.5 millimeter, a sheet of polycarbonate with a thickness of 4 millimeters, a second EVA film with a thickness of 0.5 millimeter, and a second layer of glass with a thickness of 4 millimeters, the glazing presenting a total thickness of 13 millimeters, this glazing withstanding 100 hammer blows with a force of 100 to 110 joules.

DATED: 17 April, 1989
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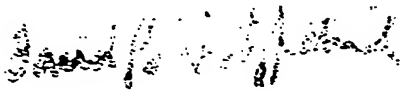

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